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# MOUNT DESERT ISLAND LAKE STUDY

Summer 1975

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College of the Atlantic

Bar Harbor, Maine

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# INTRODUCTION

The lakes of Maine are one of the state's most valuable recreational assets. ermore, the water supplies serving almost one-half the state's population erived from lakes. Increasing pollution in recent years due to domestic ndustrial wastes, however, has brought about a severe reduction in usefulness ny Maine lakes, either as a recreational resource or as a source of high ty water. These lakes have largely been victims of cultural eutrophica- or over-fertilization, which results from increased input of compounds of horus and nitrogen. Without a doubt, the largest controllable source of these ents is domestic and industrial wastewater. Several contemporary factors have ned to intensify this problem on Maine lakes. Lake shore development combined the practice of using septic tank drainfield systems to dispose of wastewater, he extended use of phosphorus compounds in synthetic detergents have resulted er-increasing quantities of nutrient-rich wastewater being discharged into ce waters since the nutrients contained in septic tank leachate enter the unding soil and may then be carried into lakes by subsurface drainage(15). Eutrophication, in the absence of human influence, is a natural process by lakes age. The youngest stage in the life of a lake is characterized by low ntrations of plant nutrients and little biological productivity, Such a lake rmed oligotrophic. As time passes, however, additional nutrients enter the and biological productivity is increased. This process of nutrient enrich- continues, until eventually the lake becomes eutrophic or highly productive. roductivity of a lake is measured in terms of the amount of aquatic plant particularly algae, that can be supported. As a consequence of nutrient en- ent, aquatic plants grow abundantly and upon their death add to the ever- asing lake sediments. The lake gradually fills in, becoming shallower by the ulation of dead plant materials and inorganic sediments, and smaller by the

roachment of shoreline vegetation. Eventually the lake disappears, and a
or marsh results, followed later by dry land (15). The principal features
trasting oligotrophic and eutrophic lakes are given in Table 1.

Eutrophication, independent of human activity, may require thousands of
rs for completion. However, it has become increasingly obvious that the
ural rate of aging of lakes can be greatly increased by human activities,
ecially those which increase the amount of available nutrients which control
al growth. The minimal essential nutrient requirements for algae are not
l-defined, but it is generally held that compounds of nitrogen and phosphor-
are chiefly responsible for the enrichment of surface waters. Thus, most
orts at slowing the eutrophication process have been aimed at controlling
input of these two nutrients.

Aside from the long-term effects of algal growth on aging of lakes, there
a number of immediate practical consequences of eutrophication. When well-
anced, lake enrichment results in accelerated seasonal growth of algae,
ecially bluegreens. These "algal blooms" result in diminution of water clar-
and upon their death their decay results in serious oxygen depletion.
ygenation, in turn, limits the lake to those fish capable of withstanding
ods of oxygen stress and excludes those, such as salmon and trout, which have
latively high dissolved oxygen requirement. Putrid masses of these bluegreens
accumulate in the shallows and along beaches, where they are often unsightly
impart a noxious odor and taste to the water. These conditions, either from
creational or water supply standpoint, are undesireable, yet are unavoid-
consequences of eutrophication.

Until recently, no base-line studies of Maine Lakes other than for fishery
gement classification have been done, with the result that problems of
rophication have gone unnoticed until well advanced. Some examples of Maine
es which have experienced serious problems of nutrient enrichment are Sebasti-
, Sabbatus, Annabessacook and Cobbossee (15). In addition, many others

le 1. Features contrasting eutrophic and oligotrophic lakes.*

| Oligotrophic | Eutrophic |
|---|---|
| p and steep banked | Relatively shallow, shelving off gradually |
| gen abundant at all depths all times. | Oxygen depleted at lower depths in summer. |
| ked transparency | Limited transparency |
| er poor in plant nutrients | Plant nutrients are abundant |
| iments low in organic ter | Organic matter high |
| ae quantitatively poor | Abundant algae |
| er blooms of bluegreens king | Water blooms common |
| tom fauna of deep basin olerant of low oxygen els. | Deep basin bottom fauna survive low oxygen |
| ytarsus-type midge larvae sent in deep basin; Chaous usually lacking | Chironomus and Chaoborus larvae typical of deep basin bottom fauna |
| p water salmon and trout | Bass, pickerel, and perch principal fish species |

Modified from Cole (12).

r to be endangered (4, 22). Recognition of the state-wide threat of phication has resulted in a three-year water quality study of 43 Maine lakes e Maine Department of Environmental Protection (26). Of the lakes to be ned, only six are in Hancock county and none of these are on Mount Desert d, in spite of the fact that the Island's lakes experience considerable ational usage and several serve as municipal water supplies.

The purpose of the Mount Desert Island lake study was to gather baseline on the water quality of Echo Lake and Long Pond since both lakes possess recreational value and are the most intensively developed lakes on the d. Long Pond, furthermore, serves as the water supply for the town of west Harbor. Another objective of the study was to inform shoreline rty owners and local officials of the nature of the eutrophication ss and how they might help impede its development. The economic implica- of the study are manifest since protection of the excellent water quality ese lakes will continue to insure high lakefront property values, pro- ve trout and salmon fisheries, excellent bathing conditions, and a potable supply for both lake residents and the surrounding towns.

A preliminary study of the water quality of Echo Lake and Long Pond was ed out in the spring of 1975 by a group of six students from College of tlantic. The present study, conducted by two COA students in the summer 75, was a continuation of the spring project and included certain activi- which best lent themselves to summer work--a sanitary survey of all lake residences and organization of a water quality workshop for lake residents. dition, the following water quality parameters were assessed: temperature, lved oxygen, transparency, alkalinity, pH, nutrients (N and P), algal popu- n, benthic macroinvertebrate population, and bacterial population.

## METHODS AND MATERIALS

The lake study was divided into four distinct phases. The

tudent interns spent the first several weeks engaged in background ork such as drawing property maps, compiling mailing lists, con- acting resource personnel, sending out letters to lake residents, cquiring materials, and reinforcing their own background know- edge.

The second and main phase was the sanitary survey. The nterns visited lake shore residences, conducted interviews, and ye-tested sewage systems. They also attempted to answer questions egarding lake eutrophication and alternative waste disposal ystems. The sanitary survey was not completed as time was hort, but approximately seventy percent of the lake residents ere interviewed.

The third phase of the study consisted of measuring those ater quality parameters which serve as useful indicators of utrophication and comparing the results with other Maine lakes hich are known to be eutrophic.

The results of the lake study were presented to the public n the final phase of the program. A meeting was held at College f the Atlantic in late August to which lake residents and inter- sted public officials were invited. Presentation of findings as followed by discussion of their implications, after which atricia Stimets, Executive Director of the Congress of Lake ssociations, spoke on how lake residents can help solve lake roblems. During the last week of the study, the student interns et a number of lake residents on Long Pond where they conducted demonstration workshop on water sampling and testing techniques.

anitary Survey

The sanitary survey was an attempt to determine to what extent

in what manner lake shore residents were contributing to the
ient enrichment of the lakes under study. The survey proce-
s were based upon those used by the Cobbossee Watershed District,
Winthrop, Maine.

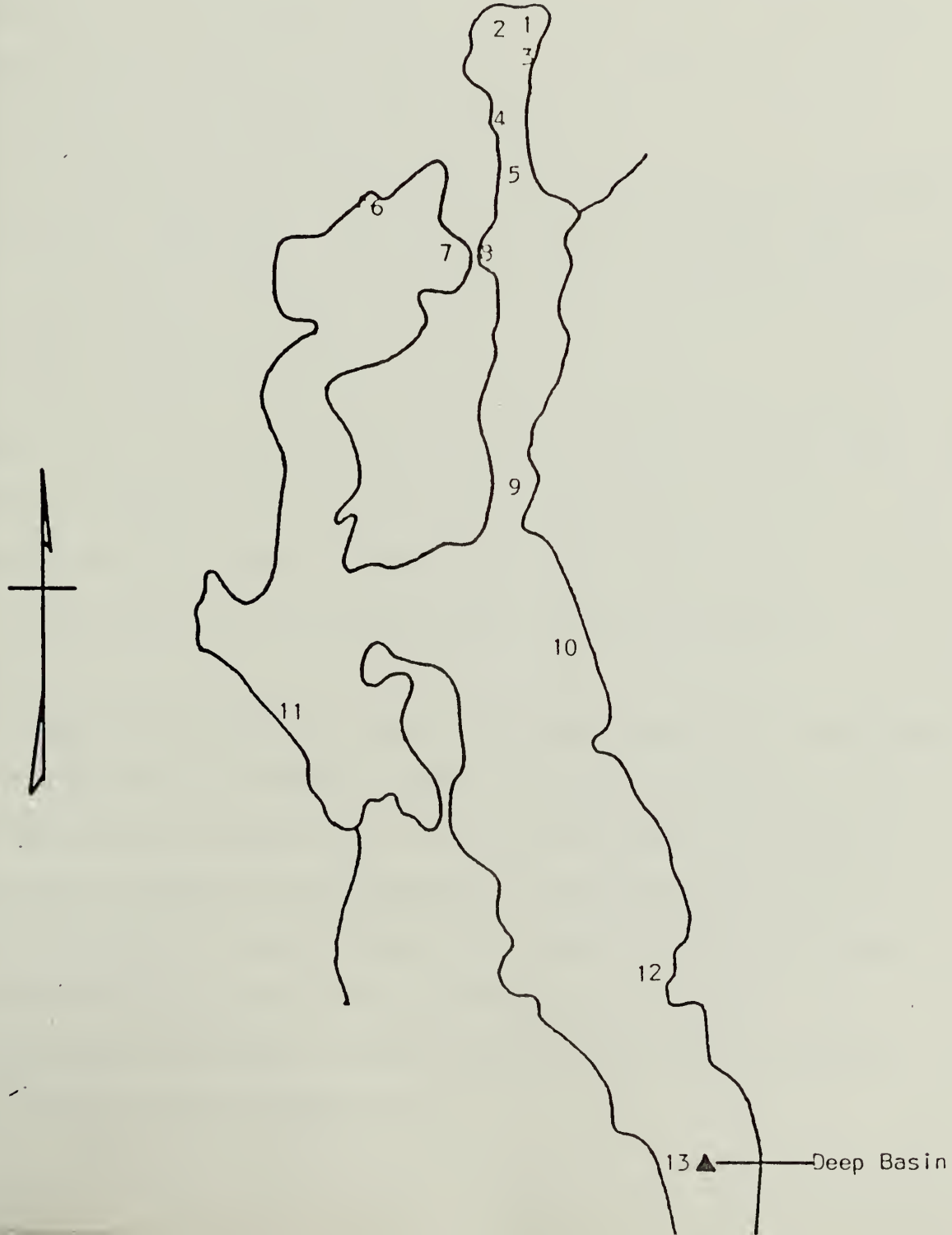
A student intern engaged in the lake study spent three days
ing with Cobbossee Watershed District personnel familiarizing
elf with their survey techniques. A list of lake shore proper-
wners was then compiled and property maps traced from the tax
rds in the town offices of Mt. Desert and Southwest Harbor.
tter (see Appendix) was sent out to all lake residents in-
ing them of the objectives of the study and advising them that
student team wished to conduct an on-site visit of their
erties. In the meantime, local plumbing inspectors were con-
ed and information obtained regarding the current condition
he lake residents' sewage disposal systems. Most properties
been inspected within the past two years and violations had
remedied. However, even though the plumbing inspectors were
led and experienced men, they were of necessity concerned
with meeting the plumbing code standards than with preserv-
lake water quality. Thus, it was felt that the information
ined by the survey would complement, rather than duplicate,
had already been done. The plumbing inspectors of the towns
t. Desert and Southwest Harbor agreed to support the student
rns should any violations of the plumbing code be uncovered.
The field work required the following equipment: 100 ft.
for measuring the distance of sewage disposal systems from
shore and property boundaries; Abney level for determining
nd slope; flourescein dye in tablet form, dissolved
ater in small vials prior to going into the field, which

used for dye-testing sewage disposal systems; and chlorine
ach and paper toweling used for cleaning up dye spills. In
tion, standard data forms (see Appendix) were taken along
used to record the following for each property inspected:
, township, map and lot numbers, house description, owner's
and addresses, name of person interviewed, months of use
year, average number of occupants, source of drinking water,
of sewage disposal system, plumbing fixtures, date of sew-
system installation, date of last pump-out, type of deter-
used, distances of buildings and disposal system from lake,
ation of leach field above lake, slope of lot, vegetation,
a site diagram. A space for tabulation of results and
lts of dye-testing were also included.

A typical interview with a cottage owner would proceed in
following manner. The survey team would approach a cottage
introduce themselves. They explained their mission and
rred to the letters which had been sent out. After a few
tes, permission was asked to flush a dye sample down the
et (sink, etc.) following which one team member would ask
tions and fill out the data form while the other member
physical measurements of the property. This entire pro-
re took about twenty minutes. Usually, however, this was
nfidence-building period and would lead into a more lengthy
less formal conversation. At the conclusion of the visit
grounds and lake shore were inspected for any sign of appear-
of the dye.

A booklet, "Cleaning Up the Water, Private Sewage Disposal
Maine" (7), and a mimeographed information sheet (see Appen-
with an explanation of the lake study on one side and lake-

. Map of Long Pond showing location of water sampling stations (2).



ater and the Secchi disc observed through the tube. Using
Secchi disc viewer" was found to reduce reading irregular-
due to variable lake surface conditions and light relfection.

inity, pH, and Nutrients. After the water temperatures
een recorded, it was possible to distinguish zones of thermal
ification. Water samples were then taken using a van Dorn
er from five depths: surface, bottom of epilimnion, center
talimnion, top of hypolimnion, and one meter off the bottom.
samples were used to determine pH, total alkalinity, ni-
nitrogen, and total and ortho-phosphates.

Total alkalinity and pH were determined simultaneously using
ning Model 7 pH meter. Since the alkalinity values were
low, a special procedure for potentiometric determination of
lkalinity was used (28).

Nitrate nitrogen was determined using the phenoldisulfonic
method (21). Samples were not corrected for chloride ion,
loride concentrations in both lakes had previously been
mined to be well below 10 ppm. A Bausch and Lomb Spectronic
lorimeter with a 2.5 cm light path was used to measure
bance.

Total and ortho-phosphate were determined using an isobutanol
ction technique followed by colorimetric determination of
olybdenum blue complex (27). Previous attempts to measure
-phosphate indicated that phosphate concentrations in both
were less than 10 ppb; hence, the above method was chosen
ts high sensitivity at low phosphate concentrations. As
e foregoing procedure, a Spectronic 20 with a 2.5 cm light
was used to measure absorbance.

al Population. The phytoplankton were sampled using a 10-meter
tion of Tygon plastic tubing (6mm inside diameter). The tubing
weighted at one end and lowered slowly into the water such
t the sample taken represented a 10-meter vertical core. Five
es were combined per sample and fixed to 5% formalin. Sample
lection, preservation, and analysis were according to the pro-
ure outlined by the Maine Department of Environmental Protection
.

thic Macroinvertebrate Population. The benthos was sampled using
5 X 15 cm Ekman dredge. Three samples were taken from the
pest part of the profundal zone of each lake during the winter
gnation period since lack of time prevented summer sampling.
procedure for collection, preservation, and analysis of samples
that outlined by the Maine Department of Environmental Pro-
tion (8) using the sucrose floatation method of Lind (18).

terial Population. Total coliform, fecal coliform, and fecal
eptococci bacteria were tested for using the membrane filter
hnique (3,6,28). The recipes for the preparation of media were
se indicated on the labels of the dehydrated media jars. In
ition to the ingredients listed, 1.5g of Difco agar were added
each 100 ml of media in lieu of using absorbant pads. All media
plates were prepared before going into the field, the number
plates having been determined in advance according to the num-
of water samples to be tested. For each test, each sample
allowed four plates, a control plate and three plates for each
three sample dilutions.

Before going into the field, glass-stoppered BOD bottles were
erilized for 20 minutes at 15 lb. pressure. In the field, samples
e taken over the side of a boat five to ten meters offshore with

entire bottle and cap immersed. Bottles were immediately
led on crushed ice and kept from direct sunlight. Upon return
the laboratory, samples were refrigerated until used. Samples
e considered good only if used before six hours had elapsed
n the time of sampling (6).

## RESULTS AND DISCUSSION

### itary Survey

The sanitary survey met with an overall favorable response.
ever, property owners were apprehensive that septic system
blems would be uncovered and that they would be reported to local
ubing inspectors, but no real problems were found that the in-
ctors were not already aware of and no formal complaints were
ed. The student interns spent more of their time talking to
e residents about water quality and lake problems than they
about the sanitary survey. The lakeshore residents were very
erested in their lakes, and it was felt that a heightened sense
awareness of lake problems was achieved through these inter-
ws aside from the information collected.

The results of the Echo Lake sanitary survey are summarized
ollows:

Systems surveyed: 29
Average months per year occupancy: 4 1/2
Lot size: 20 adequate, 9 inadequate
Sewage disposal system:
Septic tanks -- 15 Privies -- 4
Cesspools -- 8 Other -- 1
System more than 100' from the lake: 14
System less than 100' from the lake: 15
Slope of lot less than 15%: 17
Slope of lot greater than 15%: 12
Maintainance: 19 good, 10 bad
Adequate rating: 15
Inadequate rating: 14

The average figures for occupancy do not include the three

ge recreational facilities on the lake--Acadia National Park
ch, Appalachian Mountain Club camp, and Camp Beech Cliff for
s. The Park beach has an annual visitation of approximately
000 persons. It has a very adequate and well-maintained pumped-
septic system, and according to park officials, receives only
ht usage, using "only one fifth of the amount of paper per
ll than the other comfort stations in the Park". This system
tabulated as adequate. The Appalachian Mountain Club camp has
average occupancy of 100 during 10 weeks of the year. They
e four separate disposal systems, two of which are relatively
and were deemed adequate, and two of which are old cesspools
were deemed inadequate. The overall situation here is very
ubtful because of the heavy usage all systems receive. Camp
ech Cliff refused to cooperate with the survey; thus, nothing
known about the adequacy of the sewage disposal system. The
rge numbers of people bathing in Echo Lake and using the three
ove facilities can be expected to contribute to the nutrient
ad on the lake. This is borne out by the bacterial sampling,
ere the only high concentration of total coliforms (150/100 ml)
s found where the Park beach and the Appalachian Mountain Club
mp adjoin.

Of the 14 private disposal systems judged inadequate, eight
re cesspools and six were septic tanks. All the cesspools on
no Lake were thought likely to cause problems for reasons of
e and distance from the lake--the median age was 20-25 years and
e average distance 55-60 feet from the lake. The six poor septic
stems are all located in a small, swampy area near the lake
tlet. Local and state officials, and the property owners are
are of the problem and construction to remedy these systems

scheduled to begin in Septmber 1975.

A summary of results of the sanitary survey conducted on Long
d is as follows:

Systems surveyed: 74
Year around residences: no data
Average months per year occupancy: 2 1/2
Average number of occupants: 3
Lot size: 64 adequate, 10 inadequate
Sewage disposal system:
Septic tanks -- 56 Privies -- 7
Cesspools -- 10 Other -- 1
System more than 100' from lake: 52
System less than 100' from lake: 22
Slope of lot less than 15%: 45
Slope of lot greater than 15%: 29
Maintainance: 62 good, 12 bad
Adequate rating: 62
Inadequate rating: 12

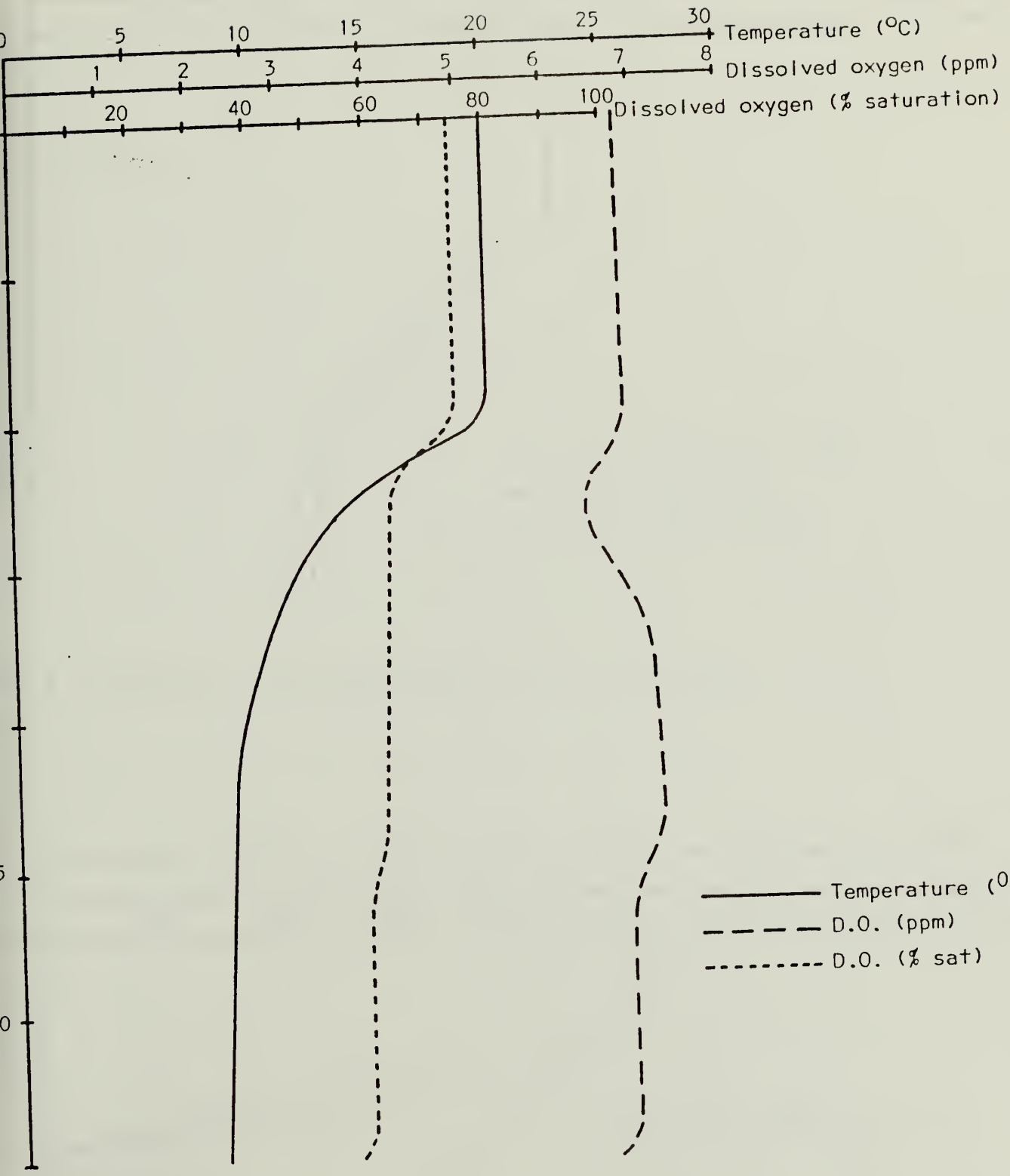
Although Long Pond has had in the past a large chicken farm,
restaurant, a dance hall, and a bottle (private drinking) club
its shores, there are now nothing but private camps. There
e no large beaches or commercial camps as on Echo Lake.

Of the 12 sewage systems deemed inadequate, seven were
sspools, four were septic systems, and one was a recirculating
emical toilet. The cesspools, here as on Echo Lake, were
d and close to the lake. One of the septic systems was only
feet from the lake. The other three were new, pumped-up
stems. Two of these were adjacent to one another and the
elds located at the top of a steep bank. There was a surface
eakthrough from both fields. The other field was in an area of
rings and flowing surface water and also had a surface break-
rough. The recirculating toilet was ten feet from a stream
nning into the lake, and, although there was a 1000-gallon
lding-tank nearby, this tank had not yet been installed or
aced in operation.

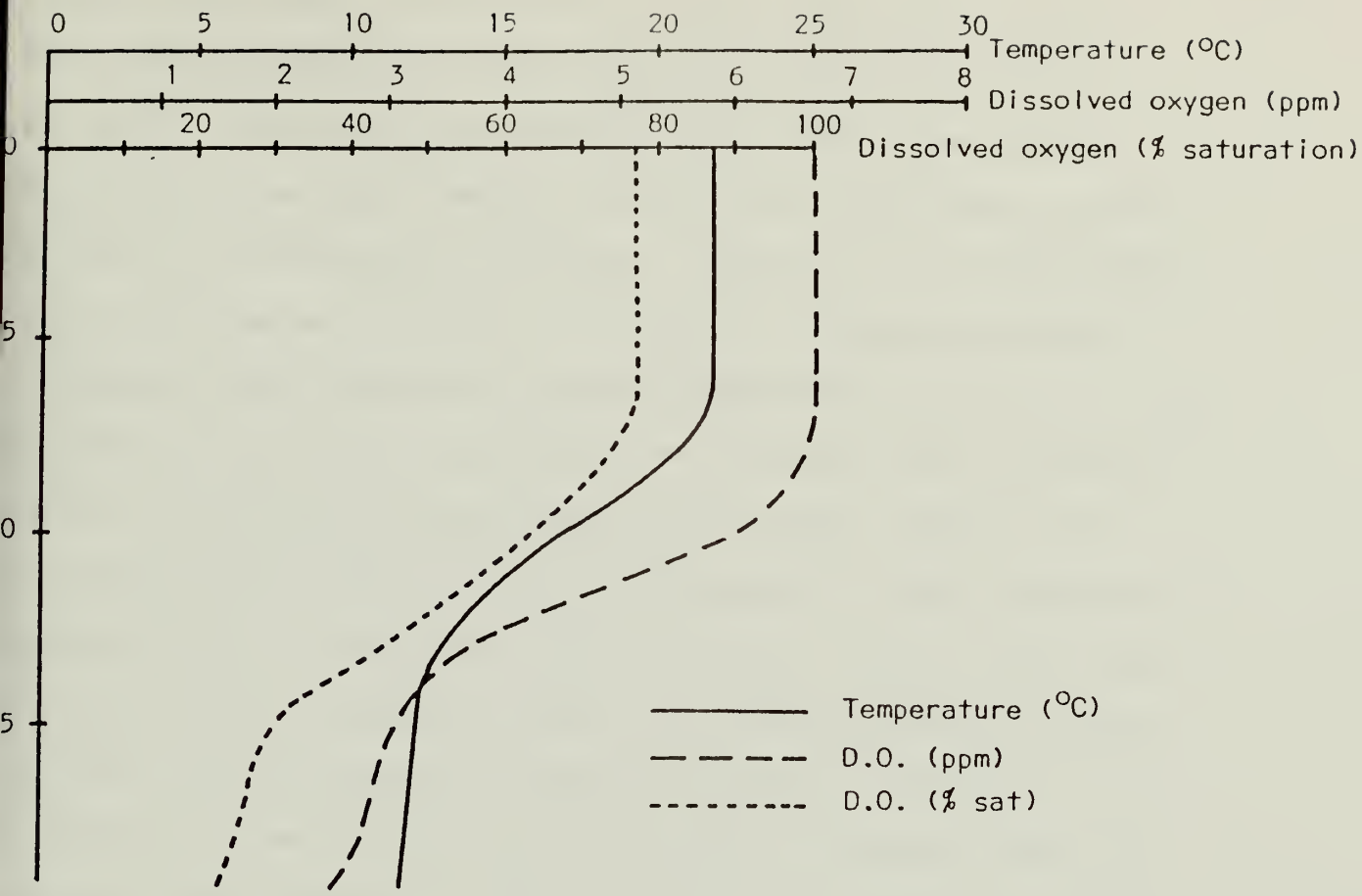
Quality Parameters

rature and Dissolved Oxygen. When a lake is very unpro-
ve or oligotrophic, the oxygen concentration in the upper
layers (epilimnion) decreases as summer stratification
s, while in the lower cool waters (hypolimnion) the oxygen
ns near 100% saturation. This ideal situation is found
ly a few extremely unproductive lakes or in moderately
trophic lakes during the very early stages of summer strat-
tion. Oxidative decay processes occur constantly in the
imnion their intensity reflected by the amount of organic
ial reaching the lower cool layers from the warm, well-
inated upper layers. The oxygen content of the lower water
s of very productive or eutrophic lakes is depleted rapidly
e process of decomposition. The resulting dissolved oxygen
le, in which the hypolimnion is anerobic is typical of eu-
ic lakes (29).

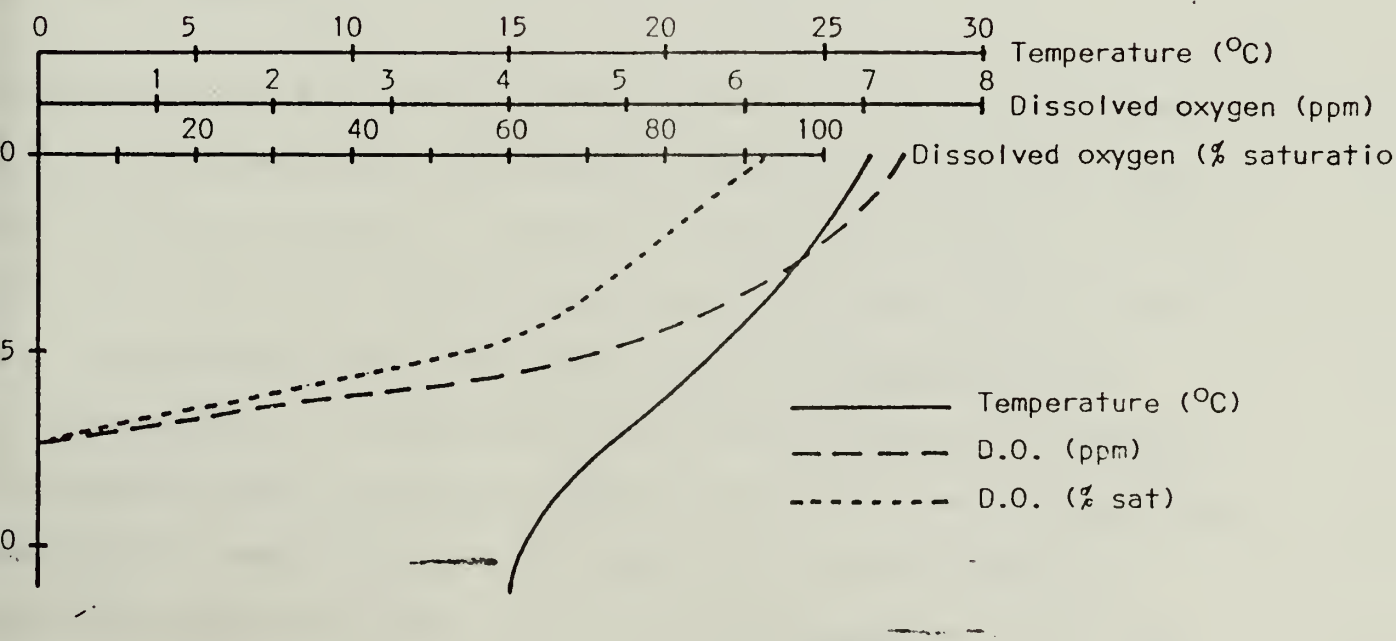
Temperature and dissolved oxygen profiles for Long Pond and
Lake are shown in Figures 3 and 4. For purposes of com-
on, a temperature-dissolved oxygen profile for Lake Winne-
a eutrophic lake located in Unity, Maine, is presented in
e 5. Examination of Figure 3 reveals that cool, well-oxygen-
water exists below 17 meters in Long Pond indicating that no
n deficit is likely to occur during the period of maximum
al stratification and that a considerable volume of the lake
itable as trout and salmon habitat even in late summer. In
ast, the dissolved oxygen-temperature profile of Echo Lake,
in Figure 4, indicates warmer temperatures and lower oxygen
s below 12 meters than are found in Long Pond. In fact,




ure 3. Temperature - dissolved oxygen profile for Long Pond.


0 5 10 15 20 25 30
Temperature (°C)
1 2 3 4 5 6 7 8
Dissolved oxygen (ppm)
20 40 60 80 100
Dissolved oxygen (% saturation)
Temperature (°C)
D.O. (ppm)
D.O. (% sat)

re 4. Temperature - dissolved oxygen profile for Echo Lake.


0 5 10 15 20 25 30
Temperature (°C)
1 2 3 4 5 6 7 8
Dissolved oxygen (ppm)
20 40 60 80 100
Dissolved oxygen (% saturation)
Temperature (°C)
D.O. (ppm)
D.O. (% sat)

re 5. Temperature - dissolved oxygen profile for Lake Winnecook.

e dissolved oxygen concentration in the cooler bottom waters
Echo Lake is about half that found in Long Pond. These
servations, taken together with the fact that Echo Lake is
h shallower and has a smaller volume than Long Pond, suggest
t, with the development of summer stagnation, the hypolimnion
the potential of becoming quite poor in dissolved oxygen.

Comparing the dissolved oxygen-temperature profiles of Long
d and Echo Lake with the profile of eutrophic Lake Winnecook
gure 5), the most striking difference is the complete ab-
ce of dissolved oxygen in the hypolimnion of Lake Winnecook.
gen depletion in the deep water indicates exceptionally high
terial activity associated with the decomposition of organic
ter and reflects the much higher biological productivity of
e Winnecook compared with the MDI lakes. Average values for
perature and dissolved oxygen in the hypolimnion of Long Pond,
o Lake, and Lake Winnecook are given in Table 2. These data
emplify the differences in trophic status of each lake, with
rophic conditions increasing in the order: Long Pond, Echo
e, Lake Winnecook.

nsparency, pH, Alkalinity, and Nutrients. Secchi disc trans-
ency, pH, alkalinity, and nutrient levels for the lakes under
dy are given in Table 3. Since no consistent changes in alka-
ity were noted with depth, the values given are profile aver-
es. Included are data from Lake Winnecook for comparison.

Differences in transparency are indicative of the abundance
suspended matter including plankton organisms, and transparency
lues may be used to assess the degree of eutrophication of
lake when considered with other water quality data (26). The

e 2. Comparison of average temperature and dissolved oxygen values in the hypolimnion of three Maine Lakes.

| | Long Pond | Echo Lake | Lake Winnecook |
|---|---|---|---|
| h to hypolimnion (m) | 17 | 12 | 7 |
| erature (°C) | 9.2 | 12.8 | 16.0 |
| olved oxygen (ppm) | 5.9 | 3.0 | 0.0 |

e 3. Comparison of physical and chemical water quality parameters for three Maine lakes.

| Parameter | Long Pond* | Echo Lake | Lake Winnecook |
|---|---|---|---|
| sparency (m) | 10.5 | 11.0 | 2.0 |
| | $6.5^{s}$<br>$6.0^{b}$ | $6.6^{s}$<br>$6.0^{b}$ | $6.5^{s}$<br>$6.4^{b}$ |
| linity (ppm $CaCO_3$) | 2.5 | 4.8 | 12.9 |
| (ppb) | $50^{s}$ | $50^{s}$ | $280^{3m}$ |
| (ppb) | ... | ... | $21^{3m}$ |

mpling dates for Long Pond and Echo Lake, August 18 through , 1975; sampling dates for Lake Winnecook, August 8 through , 1973 (23).

mples taken one meter below the surface and one meter off e bottom, respectively.

mples taken at 3 meters.

tively high transparencies of Long Pond and Echo Lake compared
Lake Winnecook indicate far less suspended matter in the MDI
s suggesting less eutrophic conditions than in Lake Winnecook.
interpretation is supported by the much higher algal den-
es observed in Lake Winnecook (see Table 4).

Changes in pH and alkalinity with depth, considered together,
be used as an index of biological activity in a lake. At the
nt of summer stagnation, pH would be expected to increase in
surface layers because of photosynthesis, whereas alkalinity
decline because of the precipitation of calcium carbonate.
e hypolimnion, conditions would be the reverse, with pH low
lkalinity high (17). Changes in alkalinity with depth were
gible in Long Pond and Echo Lake, while it increased slight-
om 12ppm to 14 ppm in Lake Winnecook, as might be expected
more eutrophic conditions.

The lower alkalinities of Long Pond and Echo Lake also suggest
levels of certain dissolved nutrients in the MDI lakes com-
with Lake Winnecook. Alkalinity, although a measure of
lved carbonate and bicarbonate, is indirectly a measure of
um and magnesium, both of which play important physiological
in aquatic organisms, especially algae, and are required
eir growth. Carbonate and bicarbonate are also forms of
dioxide, the raw material of photosynthesis, and could be
ed to increase primary production if no other factors were
ng.

s previously noted, nitrates and phosphates are extremely
ant nutrients required for the growth of aquatic plants,
ularly algae. Although there appears to be little agree-
s to the range of concentrations of these nutrients which

e eutrophic conditions, examination of Table 3 reveals far
r levels of $NO_3$-N in eutrophic Lake Winnecook compared with
Pond and Echo Lake. Unfortunately, levels of $PO_4$-P for the
akes could not be determined because of the very low con-
ations present and the resultant difficulties encountered
the phosphate analysis. However, the results of the nitrate
mination, considered together with alkalinity, suggest that
Pond and Echo Lake are poorer in total dissolved nutrients
nence, less eutrophic than Lake Winnecook.

Population. Direct measurement of algal density provides
trongest evidence of eutrophication since numbers of algae
direct manifestation of the biological productivity of a
Furthermore, certain groups of freshwater algae, notably
luegreens, come to predominate the phytoplankton during
ds of peak growth which result in "water blooms".
A comparison of the algal populations of the MDI lakes and
Winnecook during the period of summer stagnation is pre-
d in Table 4. The differences in algal populations between
DI lakes and Lake Winnecook are striking. Not only are algal
ties in late summer in the MDI lakes much smaller than in
Winnecook, but members of the bluegreen algae, whose pre-
in large numbers is indicative of highly eutrophic con-
ns, predominate in Lake Winnecook. The algal density in
Winnecook is 87 times greater than that of Long Pond and
imes greater than that of Echo Lake. Furthermore, 85% of
otal algal population in Lake Winnecook consists of bluegreens,
red with Long Pond and Echo Lake in which the bluegreens
up 2% and 15% of the total population respectively.

4. Comparison of algal populations for three Maine lakes.

| ion | Genus | Number of organisms/ml of water | | |
|---|---|---|---|---|
| | | Long* Pond | Echo Lake | Lake Winnecook |
| PHYTA | | | | |
| | Ulothrix | 12 | 4 | ... |
| | Ankistrodesmus | 1 | ... | ... |
| | Staurastrum | 8 | ... | ... |
| | Arthrodesmus | ... | ... | 1 |
| | Sphaerocystis | ... | ... | 428 |
| PHYTA | | | | |
| | Asterionella | 8 | 7 | 8 |
| | Chrysosphaerella | 3 | ... | ... |
| | Diatoma | ... | 2 | ... |
| | Dinobryon | 3 | 1 | ... |
| | Mallomonas | 1 | ... | ... |
| | Navicula | ... | 1 | ... |
| | Tabellaria | 7 | 6 | 22 |
| | Melosira | ... | ... | 32 |
| | Cyclotella | ... | ... | 13 |
| | Fragillaria | ... | ... | 267 |
| PHYTA | | | | |
| | Anabaena | ... | 1 | 1670 |
| | Polycystis | 1 | 3 | ... |
| | Microcystis | ... | ... | 1659 |
| | Gomphosphaera | ... | ... | 208 |
| | Chroococcus | ... | ... | 18 |
| | Agmenellum | ... | ... | 656 |
| PHYTA | | | | |
| | Glenodinium | 8 | 1 | ... |
| | Peridinium | 5 | ... | ... |

mpling dates for Long Pond and Echo Lake, August 20, 1975;
mpling date for Lake Winnecook, September 1, 1973 (23).

ystis and Anabaena, which dominate the bluegreens in Lake
ook, are the characteristic "water bloom" organisms (12).
bservations provide the strongest evidence that Long Pond
ho Lake are relatively nutrient-poor and far less eutrophic
ake Winnecook.

: Macroinvertebrate Population. There are striking
ences in the benthic macroinvertebrate fauna of the Mount
Island lakes and Lake Winnecook as shown in Table 5. Most
e are the dominance of the bottom fauna of Long Pond and
ake by the dipteran genera Chaoborus, Chironomus, and
s. In contrast, smaller numbers of dipteran larvae
ented by the genera Chaoborus, Cryptochironomus, and
a are found in the bottom sediments of Lake Winnecook.
r important dissimilarity between the lakes is the presence
dge worms of the genera Tubifex and Limnodrilus in Lake
ook and their complete absence from Long Pond and Echo Lake.
lthough the genera Chaoborus and Chironomus are often
ated with eutrophic conditions (12), their appearance in
numbers in the MDI lakes compared with Lake Winnecook comes
urprise. One might normally expect the opposite situation.
esence of these organisms in the relatively nutrient-poor,
xygenated waters of Long Pond and Echo Lake might be
ted for by the fact that members of these genera can tolerate
range of dissolved oxygen conditions. Chironomus, for
e, has been collected from habitats in which the dissolved
concentration has ranged from 1-14 ppm (25). The Chir-
ae, including the genera Chironomus, Tanypus, Crypto-
omus, and Brillia, are the most ubiquitous aquatic insects (25),

le 5. Comparison of benthic macroinvertebrate populations for three Maine Lakes.

| lum | Class | Genus | Number of organisms/square meter of bottom | | |
|---|---|---|---|---|---|
| | | | Long Pond* | Echo Lake | Lake Winnecook |
| HROPODA | | | | | |
| | Insecta | | | | |
| | | Chaoborus | 11873 | 9727 | 2013 |
| | | Chironomus | 286 | 1859 | ... |
| | | Tanypus | 143 | 286 | ... |
| | | Cryptochironomus | ... | ... | 133 |
| | | Brillia | ... | ... | 143 |
| | Arachnida | | | | |
| | | Neumania | ... | 286 | ... |
| ELIDA | | | | | |
| | Oligochaeta | | | | |
| | | Tubifex | ... | ... | 198 |
| | | Limnodrilus | ... | ... | 209 |

Sampling dates for Long Pond and Echo Lake, April 21-22, 1975; sampling date for Lake Winnecook, April 21, 1974 (23).

l their presence *per se*, in the absence of supporting evidence, not be a reliable index of the trophic status of a lake.

More explainable is the presence of the worm genera *Tubifex* i *Limnodrilus* in the bottom sediments of Lake Winnecook and eir absence from Long Pond and Echo Lake. Both genera are ghly resistant to oxygen stress, and, although present in lean" environments, may come to dominate the bottom fauna der anoxic conditions (11). Their absence from Long Pond and no Lake is an indication of lower levels of organic matter composition in the bottom sediments of the MDI lakes suggesting ss eutrophic conditions than prevail in Lake Winnecook.

cterial Population. Natural waters contain many types of cteria, some of which have their origin in the excremental waste warm-blooded animals, including humans. Although not commonly ed as an index of eutrophication, levels of such bacteria may indicative of sewage discharge into lake waters, and indirect-, nutrient input.

A group of easily cultivated bacteria is used to indicate e presence of fecal contamination of surface waters. These dicator organisms include total coliforms, fecal coliforms, d fecal streptococci.

Total coliform counts have been the most widely employed thod of estimating fecal pollution since the total coliform nsity is roughly proportional to the amount of excremental ste present (6). Total coliform population limits have been t by federal and state health services, these limits varying th the designated use of the water supply. For example, e Maine Department of Health and Welfare designates 1 coliform

olony per 100 ml as the upper limit for drinking water requiring no disinfection, higher values indicating unsatisfactory onditions requiring sterilization if the water is to be used or drinking or cooking purposes (10). The Maine Department f Environmental Protection, in its classification of fresh urface waters, designates that those of highest quality Class A) shall contain not more than 100 colonies per 100 ml, nd that such waters can be used for recreational purposes, ncluding bathing, and for public water supplies after disinfection (5). With certain exceptions, high total coliform counts re suggestive of significant contamination by excrement of arm-blooded animals, but high coliform levels must be interpreted with caution since (a) they may have their origin in the eces of birds and wild mammals, in addition to humans, and b) certain members of this group are also present in soils and n vegetation (10).

Fecal coliform counts are becoming more commonly employed s pollution indices because of their relatively infrequent ccurence except in association with fecal pollution. Moreover, hen accompanied by fecal streptococci counts, fecal coliform alues may aid in the differentiation of animal from human aste (6). Because survival of the fecal coliform group is horter in fresh surface waters than for the coliform group as whole, high fecal coliform levels also indicate relatively ecent pollution (6).

Since fecal streptococci do not occur and cannot reproduce except in the intestinal tracts of warm-blooded animals, heir presence in surface waters indicates the existence of ecal pollution by warm-blooded animals. Furthermore, when

:companied by fecal coliform studies, fecal streptococci
:terminations serve as a valuable tool in differentiating
nimal from human wastes. In intestinal wastes of human origin,
he ratio of fecal coliforms to fecal streptococci tends to be
reater than four. In comparison, when such ratios are deter-
ined for intestinal wastes from non-human sources, the values
end to be markedly less than 0.7 (6).

In this study an attempt was made to determine total coli-
orms, fecal coliforms,and fecal streptococci. The fecal coliform
ounts were deemed invalid because of technical difficulties
ncountered in keeping the plates uniformly incubated and free
f water. The total coliform and fecal streptococci counts for
ong Pond and Echo Lake are given in Table 6 along with total
oliform counts from Lake Winnecook. Station locations are
iven in the Appendix and are shown on the maps in Figures
and 2.

The data in Table 6 indicate that higher levels of total
oliform bacteria are found in Lake Winnecook than in Long Pond
nd Echo Lake, and, of the MDI lakes, Long Pond has a lower
verage total coliform count than Echo Lake. These results
uggest that lower levels of fecal pollution exist in the MDI
akes and that the levels of nutrient input from human sources
ight also be lower. The highest value for total coliforms was
50 colonies per 100 ml, which was found at the Acadia National
ark beach on Echo Lake and which probably was derived from the
arge concentration of bathers in the area. The values observed
or fecal streptococci are of interest since a number of lo-
ations were free of these bacteria, indicating that a large
raction of the total coliforms may have been derived from other

Echo Lake is about one-half that of Long Pond, then nutrient
oading (due to human contributions of all types) can be expected
be far greater in Echo Lake than in Long Pond. This suggests
at Echo Lake is much more predisposed to cultural eutrophication
an is Long Pond. Since 50% of the private sewage disposal
stems surveyed on Echo Lake were deemed inadequate compared
th only 16% on Long Pond, it is apparent, in light of the pre-
eding discussion, that a more vigorous effort is required by
ho Lake residents in preventing or intercepting nutrient flow
to the lake.

Due to the location and topography of both Echo Lake and
ng Pond, there is little probability that lakeshore residences
ll be connected to a municipal sewerage system in the foresee-
le future. Thus, careful planning and use of individual sys-
ms will continue to be a common practice. Septic systems are
limited lifespan since they involve percolation [illegible]

kes.

Lake Winnecook

| Station | Total Coliforms (cells/ 100 ml) |
|---|---|
| A | 18 |
| B | 34 |
| C | 0 |
| D | >800 |
| E | 40 |
| L | 68 |
| | 137 |

75; sampling date for Lake Winne-

erious problem, compared with the disposal of excremental stes. However, "grey water" contains a large fraction of ne plant nutrients, especially phosphates, which enter disposal stems. Thus, the least expensive and most convenient solution preventing nutrient enrichment of lake waters is for lake sidents to refrain from using phosphate-containing detergents. list of recommended phosphate-free detergents is given in e Appendix.

A summary of water quality parameters which illustrate e important differences between the MDI lakes and Lake Winnecook given in Table 7. The shallow depth, absence of dissolved ygen in the hypolimnion, elevated bottom temperature, limited ansparency, high levels of dissolved nutrients, high algal nsities, predominance of bluegreen algae, and the presence of udge worms in the deep basin sediments of Lake Winnecook defin-ely characterize the lake as eutrophic (compare these with the ke features in Table 1). In contrast, the MDI lakes are deeper, ssess higher levels of dissolved oxygen in the hypolimnion, ve cooler bottom waters, far greater transparency, lower levels nutrients, much lower algal densities, and do not have udge worms in the deep basin sediments. Thus, the MDI lakes e far less eutrophic than Lake Winnecook.

Comparing the MDI lakes with each other, as brought out the previous discussion, Echo Lake is more predisposed to ltural eutrophication due to the threat of nutrient loading an is Long Pond. Furthermore, the water quality data pre-nted in table 7 suggest that Echo Lake is more eutrophic than ng Pond. This may be inferred from Echo Lake's shallower

.ble 7. A summary of water quality parameters comparing three Maine lakes.

| | Long Pond | Echo Lake | Lake Winnecook |
|---|---|---|---|
| ean depth* (m) | 14.0 | 8.5 | 5.3 |
| ssolved oxygen in ypolimnion (mean saturation) | 51 | 28 | 0 |
| ypolimnion temperature ean °C) | 9.2 | 12.8 | 16.0 |
| ansparency (m) | 10.5 | 11.0 | 2.0 |
| $O_3$-N (ppm) | 50 | 50 | 280 |
| lkalinity (ppm $CaCO_3$) | 2.5 | 4.8 | 12.9 |
| lgal population rganisms/ml) | 57 | 26 | 4982[bg] |
| udge worms in bottom ediments (organisms/$m^2$) | 0 | 0 | 407[tl] |

Estimated by summing the values of the depth soundings on the Maine Department of Inland Fisheries and Game maps (1,2) and dividing by the number of soundings.

Algal population of Lake Winnecook dominated by blue-green algae.

Sum of Tubifex and Limnodrilus spp.

epth, greater oxygen depletion in the hypolimnion, and warmer ottom temperatures. On the other hand, the transparency of cho Lake is similar to that of Long Pond, while Echo Lake's lgal density is lower than that of Long Pond. Since the algal ounts were based upon a single sampling of each lake, these ifferences in algal densities are probably more apparent than eal.

## ECONOMIC IMPACT

A study such as this should not be expected to have any mmediate economic impact, except, perhaps, by encouraging a igher level of maintainance of present sewage disposal systems r installation of new ones. In contrast, the long-range economic mplications are profound. Even if the simple measure of dis- ensing with phosphorus-containing detergents is followed by ake shore residents, the rate of cultural eutrophication will e slowed considerably. This means that high lakefront property alues, productive trout and salmon fisheries, excellent swimming onditions, and a potable water supply will be protected to be njoyed for many more years to come.

## RECOMMENDATIONS FOR THE FUTURE

The results of this study, especially the water quality ork, are based upon a minimum number of observations. This recluded an understanding of seasonal fluctuations in water uality; for example, if an algal bloom had occured on Echo Lake wo weeks prior to sampling, it simply would have passed unnoticed. urthermore, difficulties encountered with the phosphate analysis

revented a more detailed assessment of dissolved nutrients vailable for algal growth. It also became apparent that some ater quality parameters were more useful than others in estab- ishing the trophic status of a lake; for example, measurement f algal populations was more meaningful than examining benthic acroinvertebrate populations.

With the above limitations to the present investigation in ind, it is proposed that the eutrophication study of Long Pond nd Echo Lake be continued for another year, with the emphasis laced upon gathering water quality data over a 12-month period t weekly or biweekly time intervals, depending on the season. he water quality parameters to be measured should include: ransparency, temperature, dissolved oxygen, conductivity, and lgal population. The first four measurements can be carried ut rapidly in the field, while assessment of the algal popu- ation would involve more extensive laboratory evaluation. The dvantage of such an approach, compared with one-time sampling, ould be to give a much more accurate picture of the biological roductivity of the MDI lakes on an annual basis. With these ase-line data available, when the lakes are examined at some uture date to determine what changes in water quality have ccured, a much more precise assessment of the changes will be ossible.

Anonymous. 1969. Echo Lake. Lake survey map no. 333, Maine Department of Inland Fisheries and Game, Augusta.

Anonymous. 1969. Long Pond (Great Pond). Lake survey map no. 345, Maine Department of Inland Fisheries and Game, Augusta.

Anonymous. 1969. Millipore experiments in environmental microbiology. Millipore Corporation, Bedford, Massachusetts. p. 8-22, 38-40.

Anonymous. 1970. Cultural eutrophication of Maine lakes. Information Memorandum, Water Resource Center, University of Maine at Bangor.

Anonymous. 1973. Classification of surface waters. Department of Environmental Protection Revised Statutes of 1964, Maine Department of Environmental Protection, Augusta. 57p.

Anonymous. 1974. A curriculum activities guide to water pollution and environmental studies, vol. 2. Institute for Environmental Education, Cleveland, Ohio. p A1-65 to A1-95.

Anonymous. 1974. Cleaning up the water: Private sewage disposal in Maine. Maine Department of Environmental Protection, Augusta. 29p.

Anonymous. 1974. Standard procedures for sampling benthic macroinvertebrate communities. Maine Department of Environmental Protection, Augusta. Mimeo. 11p.

Anonymous. 1974. Standard procedures for sampling phytoplankton communities. Maine Department of Environmental Protection, Augusta. Mimeo. 6p.

Anonymous. 1975. Water sanitary analysis. Form HPHL-8, Maine Department of Health and Welfare, Augusta.

Brinkhurst, R.O., and D.G. Cook. 1974. Aquatic earthworms (Annelida: Oligochaeta), p.143-156. In C.W. Hart and S.L.H. Fuller (eds.), Pollution ecology of freshwater invertebrates. Academic Press, Inc., New York.

Cole, G.A. 1975. Textbook of limnology. C.V. Mosby Co., St. Louis. p.7-13, 25-26, 202.

Gordon, T.U. 1974. Cobbossee watershed district annual report, 1973-74. Cobbossee Watershed District, East Winthrop, Maine. Mimeo. 74p.

Gordon, T.U. 1974. Cobbossee watershed one year later. Maine Environment, December, 1974. p.1-2. Natural Resources Council of Maine, Augusta.

Hall, M.W. 1971. Your lakes are aging too fast! Maine Fish and Game, Spring, 1971. Maine Department of Inland Fisheries and Game, Augusta. 6p.

Hooper, F.F. 1969. Eutrophication indices and their relation to other indices of ecosystem change, p.225-235. In Eutrophication: Causes, consequences, correctives. National Academy of Sciences, Washington, D.C.

Jonasson, P.M. 1969. Bottom fauna and eutrophication, p.274-305. In Eutrophication: Causes, consequences, correctives. National Academy of Sciences, Washington D.C..

Lind, O.T. 1974. Common methods in limnology. C.V. Mosby Co., St. Louis. p.22-23, 120-130, 132-137.

Olday, F.C. 1974. Determination of dissolved oxygen in water: Polarographic method. College of the Atlantic, Bar Harbor, Maine. Mimeo. 9p.

Olday, F.C. 1974. Determination of dissolved oxygen in water: Winkler method. College of the Atlantic, Bar Harbor, Maine. Mimeo. 8p.

Olday, F.C. 1974. Determination of nitrate in water. College of the Atlantic, Bar Harbor, Maine. Mimeo. 6p.

Pollard, J.A. 1973. Polluted paradise. Twin City Publishers, Lewiston, Maine. p.208-215.

Rabeni, C.F. 1974. Winnecook -- A look at a lake. Unity College, Unity, Maine. 44p.

Reid, G.K., and R. D. Wood. 1975. Ecology of inland waters and estuaries, 2nd ed. Van Nostrand Reinhold Co., New York. 485p.

Roback, S.S. 1974. Insects (Arthropoda: Insecta), p.314-376. In C.W. Hart and S.L.H. Fuller (eds.), Pollution ecology of freshwater invertebrates. Academic Press, Inc., New York.

Scott, M. 1974. Proposed three-year lake eutrophication and monitoring project. Interdepartmental Memorandum, Maine Department of Environmental Protection, Augusta. May 3. 4p.

Stephens, K. 1963. Determination of low phosphate concentrations in lake and marine waters. J. Limnol. Oceanog., 8: 361-362.

Taras, M.J., et al (eds.). 1971. Standard methods for the examination of water and wastewater, 13th ed. American Public Health Association, Washington, D.C. p.52-56, 678-685, 688-691.

Wetzel, R.G. 1975. Limnology. W.B. Saunders Co., Philadelphia. p.125-128, 636-645.

# APPENDIX

n-phosphate cleansing agents recommended for use by lake residents*

r Soaps

Ivory
Irish Spring
Palmolive
Safeguard
Cashmere Bouquet

quid Dishwashing Detergents

Staff Lime, Lemon, Pink Lustre
Lemon Chiffon
Palmolive
Joy
Ivory Liquid
Thrill
Dove
Lux
Ajax
Octagon

Laundry Soap Powders

Arm & Hammer
Ivory Snow
Ivory Flakes
Instant Fels
Purex

Liquid Laundry Detergents

Era
Dynamo
All

Liquid Fabric Softeners

Rain Barrel
NuSoft
Staff Soft Fabric Rinse

* If in doubt, check container labeling; most products specify if phosphates are present or not, and if they are, the percentage by weight of phosphorus.

Location of bacterial sampling stations, Mount Desert Island Lake study, summer 1975.

Long Pond

| Station | Location |
|---|---|
| 1 | Boat ramp |
| 2 | Kane/Shaw |
| 3 | Kelmenson/Cote |
| 4 | Armstrong/Ross |
| 5 | Haraden |
| 6 | Contrini |
| 7 | Van Allen |
| 8 | Causeway |
| 9 | Hinckley |
| 10 | Poulton |
| 11 | West Arm Beach |
| 12 | Sellers |
| 13 | Deep Basin |
| 14 | Tyson |

Echo Lake

| Station | Location |
|---|---|
| 1 | Russell |
| 2 | Fuerst |
| 3 | Pfeiffer |
| 4 | Camp Beach Cliff |
| 5 | Deep basin |
| 6 | ANP beach |

# College of the Atlantic

Bar Harbor, Maine

June 23, 1975

Dear

This summer a small group from the College of the Altantic is conducting a program of sewage system testing around Echo Lake and Long Pond. The purpose of this survey is to gather background information for a long range study of the water quality of the lakes of MDI and to provide landowners with information about private sewage disposal and lakeshore ecology.

The testing will be done with a harmless bright red dye which will be flushed down toilets and placed in drains. The survey personnel will also ask several questions about your sewage system (when it was installed, what size, etc.), take a small soil sample, and make several measurements on your property.

The survey personnel have been trained in water quality testing techniques and environmental law, and will help you with any questions or problems you might have with the State Plumbing Code, the Great Ponds Act, or municipal shoreland zoning. They will be carrying informative material relating to these environmental laws; we hope you will make use of this information as needed.

The survey will take place during July. If you will be at your cottage only on certain days or weekends of the summer, we would appreciate it if you could call or write us, so that we may schedule you for that time. We believe that this survey will be helpful to you in improving your property and maintaining the water quality of the lake. Also, if you have any questions about our survey or about any environmental problems that you are concerned with, please contact us at the college. Our telephone number is 288-5015. We are here to help and we look forward to meeting you this summer.

In August we plan to conduct a workshop and field trip in order to inform lakeshore residents of the results of the study and to train interested persons in basic water sampling and monitoring techniques. Further information on the workshop and field training session will be forthcoming.

Sincerely,

Fred C. Olday, Ph.D.
Director
Lake Study Program

# MOUNT DESERT ISLAND LAKE STUDY

The unsurpassed natural beauty of Mount Desert Island annually draws millions of visitors from other parts of the United States. An important feature of the scenic landscape and a natural resource of high recreational value are the Island's lakes. In addition to their use as vacation home sites and for fishing, swimming and boating activities, a number of these lakes also serve as municipal reservoirs.

To date, no thorough scientific study of the water quality of the lakes has been done. The Mount Desert Island Lake Study is a five-year program conceived and directed by Dr. Fred Olday, faculty member in biology at the College of the Atlantic, to gather baseline, physical, chemical, biological, and cultural data. In addition, the lake study hopes to inform the local users of the lakes about the results of the study, to create public awareness of the problems of lake pollution, and to train students, local residents and local officials in techniques of water quality monitoring. Endorsement of the study is given by Acadia National Park, the Park Coordination Commision and the Echo Lake Association.

Work began this spring, when a group of six students from COA began the mapping, sampling, and analysis of Echo Lake and Long Pond. The study is continuing this summer and will include an aquatic vegetation survey, a sanitary survey of all lake shore residences, and orginazation of water quality workshops for lake residents. In addition, the following physical, chemical and biological parameters of water quality will be assessed during the summer stagnation period: temperature profile, dissolved oxygen profile, nutrients (N and P), bacterial population, algal population, color, transparency and conductivity.

# HOW YOU CAN HELP THE LAKE

o not fertilize lawns and gardens near the lake.

o not disturb the natural shoreline vegetation, rocks, and soil; aintain a buffer strip of natural vegetation between gardens, amps, and the waterline.

ry to keep or plant trees between the lake and your septic tank eaching field.

se low or no-phosphate detergents.

imit washing machine use and use local laundramats.

o not bathe or shampoo in the lake.

o not put cooking oils and grease in your toilet.

djust toilet to use less water; put a brick in the toilet tank f necessary to reduce water volume.

ut down on shower time and water use throughout the house.

ncourage and use rowboats and canoes.

ave your septic tank cleaned and pumped frequently. The follow- ng is a list of septic tank pumpers that service your area:

| | |
|---|---|
| Robinson Hardware and Sheet Metal Co.<br>Main Street, Southwest Harbor | 244-3200 |
| Trenton Plumbing and Heating<br>Trenton | 667-5135 |
| Ray Plumbing and Heating<br>High Street, Ellsworth | 667-5536 (local)<br>800 432-7826 (tollfree) |
| off hours (private)<br>Donald Sullivan, Jr.<br>Northeast Harbor | 244-3275 |

f you have any questions or suspect problems with the water uality of your lake, contact your local town office and if you ish to help with this study, telephone or come to the College f the Atlantic in Bar Harbor (288-5015) and ask for the summer ake study interns.

August 1976

Dear Lakeshore Resident,

On Saturday morning, August 23rd, the College of the Atlantic Lake Study Group will hold a workshop in the auditorium at the College campus on Eden Street in Bar Harbor.

The purpose of the workshop is to inform interested persons of the goals of the Lake Study and to present the results of this summer's work. In addition, we will present a speaker from the Congress of Lake Associations and a discussion of the possibility of forming a Long Pond Watershed Association. Finally, a time will be arranged for interested persons to participate in a field session dealing with water monitoring techniques.

WATER QUALITY WORKSHOP
Saturday morning, August 23, 1975
COLLEGE OF THE ATLANTIC AUDITORIUM

| | |
|---|---|
| 8:30 - 9:00 | Coffee and doughnuts |
| 9:00 | Introduction and Explanation of the Goals of the MDI Lake Study<br>Dr. Fred Olday, Director |
| 9:30 | Results of this Summer's Sanitary Survey of Echo Lake and Long Pond<br>Karen Roy, Student Intern |
| 10:00 | Results of this Summer's Water Quality Analysis of Echo Lake and Long Pond<br>Bruce Bender, Student Intern |
| 10:30 | Concluding Remarks. Organization of a field trip to demonstrate water quality monitoring techniques. |
| 10:45 | Break -- Refreshments |
| 11:15 | "Maine Lakes and Lake Problems"<br>Patricia Stimets, Executive Director, Congress of Lake Associations of Maine |
| 12:00 | Discussion-- Formation of a Long Pond Watershed Association -- Representatives of the Long Pond Ripples Camp Association |

. Adler
rt, ME

& Jacqueline H. Agnese
or, ME 04609

Ursula Apel
st Second St.
gton, IN 47401

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, NJ 08885

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ady Glen Lane
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st Harbor, ME 04679

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ingside Drive
k, NY

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ey St.
adley, MA 01035

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ert, ME

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ve Rd.
ert, ME

. Fernald
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Funeral Home
ert, ME

Fernald
ert, ME

Fernald
ert, ME

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e & Robert Goldberger
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Kain
sert, ME

ia L. Kane
ond
sert, ME

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